

ACKNOWLEDGEMENTS

I am grateful to Dr R. V. Sitholey, Acting Director, National Botanic Gardens, Lucknow for facilities of work and Prof. P. V. Bole, St. Xavier's College, Bombay for comments.

NATIONAL BOTANIC GARDENS,
LUCKNOW,
November 18, 1972.

K. M. BALAPURE

36. *THELYPTERIS AUGESCENS* (LINK) MUNZ & JOHNSTON: A
NEW RECORD FROM INDIA
(With ten text-figures)

During the course of our study on the thelypteroid ferns, the senior author came across the plants which conformed to the description of *T. augescens* (Link) Munz & Johnston. The specimens were sent to Prof. R. E. Holttum, Kew, England and to Dr. Alan R. Smith, University of California who confirmed the identity of the species, a native of Southern Florida, Cuba and the Islands of Andros and New Providence in the Bahamas. This species was originally described as *Aspidium augescens* by Link in 1841 from a cultivated plant raised from the spores in the Botanic Garden at Berlin. Recently, Smith (1971)¹ has described it along with the other thelypteroid ferns of Southern United States. In India, the plants of *T. augescens* were collected from Valparai, Coimbatore and are a new record. They have been introduced in the fernery of National Botanic Gardens, Lucknow.

Thelypteris augescens (Link) Munz & Johnston is a mesophytic terrestrial fern, growing usually in exposed beds, forming extensive dense clusters. The rhizome is long creeping,

¹ SMITH, A. R. (1971): The *Thelypteris normalis* complex in Southern United States. *Amer. Fern. J.* 71:21-32.

c. 1 cm across, usually branched and covered with persistent leaf bases and paleae. Mixed with the paleae, unicellular, acicular hairs occur on the surface of the rhizome. Paleae are basally attached, non-clathrate ovate-lanceolate with a broad base and gradually tapered apex (Fig. 1). The apex of palea is terminated by a large globular, glandular cell with dense contents. Paleae are profusely hairy. Unicellular, acicular hairs are borne all over the margin and surface of palea. Mixed with the acicular hairs a few unicellular, glandular hairs (with extracellular cap-like secretion at the apex) also occur on the margin of the paleae (Fig. 7). In some paleae, large, multicellular, glandular hair with a globular terminal cell and 1-5 celled stalk occur in addition on the margin of the palea; sometimes, unicellular, acicular hair is borne on the stalk of the hair (Fig. 6). In the young palea a few large subglobose hairs with dense yellowish-brown contents occur on the margin of the paleae; the hairs are devoid of any secretion and are sometimes stalked. These hairs are usually borne towards the basal-half region of the palea and are shed off towards maturity.

The ground tissue of the rhizome consists of thin-walled parenchymatous cells; the cells

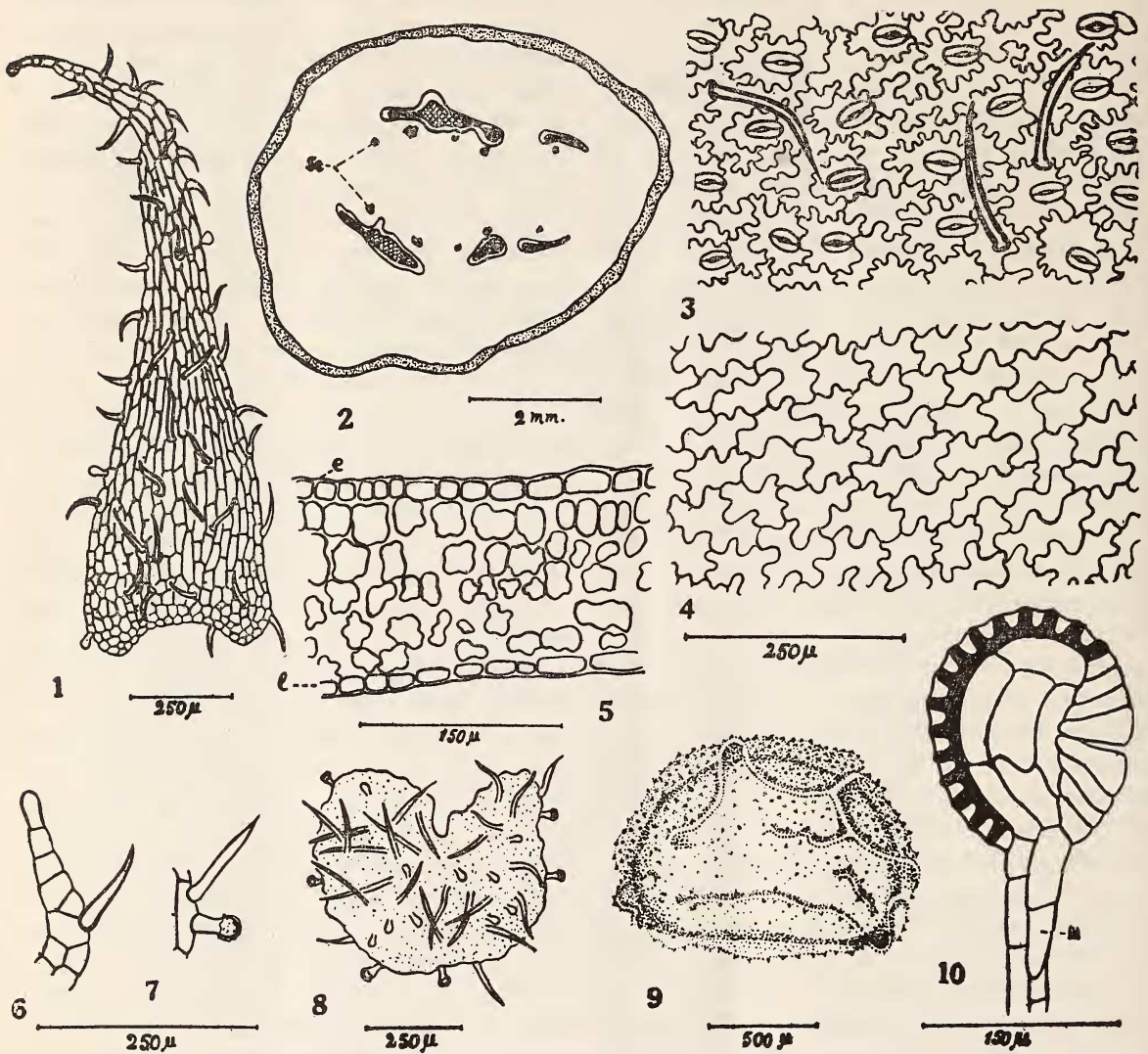
are densely filled with starch deposits. A few irregularly cylindrical strands of sclerenchyma (4-10 cells thick) occur in the ground tissue restricted to the sides of stelar cylinder on either surface (Fig. 2). These strands consist of highly thick-walled dark brown cells with occluded lumen (Fig. 2--sc). The epidermis of the rhizome is thick-walled. Below the epidermis there is a distinct hydodermal sheath (8-10 layers thick) of thin-walled parenchyma cells; the cells of hypodermis are devoid of contents. The vascular cylinder of the rhizome is dictyostelic, dissected into broad 2-3 ribbon shaped meristele by spirally arranged leaf gaps. Phloem tissue is narrow and surrounds the xylem on all the sides. Pericycle is usually two layered. Endodermis is not very prominent as in the case of other thelypteroid ferns. The cells of endodermis are elongated and radially compressed with slightly thickened radial wall.

Leaves are pinnate and spirally arranged around the rhizome. The stipe is smooth, glabrous and prominently grooved on the adaxial surface. The ground tissue of the stipe is parenchymatous except for a peripheral sclerenchymatous sheath. The peripheral sheath consists of 6-8 layers of thick-walled cells interrupted laterally on either side by prominent aerating bands of loosely arranged parenchyma cells. Irregular strands of sclerenchyma as found in the rhizome occur in the ground tissue of the stipe adjacent to the either surface of vascular bundles. These strands extend up to the apex of the stipe and end blindly. The vascular supply of the stipe consists of a pair of broad, ribbon-shaped, laterally placed vascular strands. Rachis is similar to the stipe in structure and is prominently grooved on the adaxial surface. Unlike stipe, the rachis is hairy; unicellular acicular hairs occur sparsely all over the surface of the rachis.

The frond is ovate-lanceolate in outline with

c. 26 pairs of lateral pinnae and a distinct terminal pinna. The lateral pinnae are narrow, much elongated (*c.* 9 inch long and *c.* 2 cm broad) and are dissected more than half way to midrib into oblong falcate segments. The basal segment of the lower pinna is distinctly larger than the more distal pinnules. The venation is free and pinnate with primary lateral veins corresponding to the marginal lobes. The main lateral veins are pinnately branched bearing a large number of closely placed unbranched secondary veins which extend obliquely to the margin of the pinna; the veins usually possess clavate apices. The leaf lamina is thick and leathery. Both the upper and lower epidermis are chlorophyllous (Fig. 5--e, 1). The upper epidermis consists of large cells with irregular contour (Fig. 4). The cells of lower epidermis are similar in shape to those of upper epidermis but have the outline more conspicuously sinuous with smoothly rounded indentation (Fig. 3). The mesophyll cells are distinguishable into upper elongated, compactly arranged, palisade-like cells and the lower with short hump-like arms (Fig. 5). The midrib of the pinna is grooved on the upper surface and is profusely hairy. Unicellular, elongated, acicular hairs are borne all over the midrib on both the surfaces; sometimes the acicular hairs are septate. The lateral veins and nonvenous areas on the upper surface are however, devoid of trichomes. Acicular hairs are profusely borne all over the lower surface of the lamina; the hairs in the nonvenous areas being slender and much reduced.

The fertile leaves are similar to the sterile ones. Sori are circular, superficial and medianly borne over the secondary lateral veins. The indusium is one cell thick with smooth margin and is composed of narrow elongated radially arranged cells (Fig. 8). Large acicular hairs, similar to the foliar hairs, occur profu-



Thelypteris augescens (Link) Munz & Johnston

Fig. 1. Mature palea. Fig. 2. T. S. of rhizome. Fig. 3. Lower foliar epidermis. Fig. 4. Upper foliar epidermis. Fig. 5. T. S. of a portion of the lamina. Fig. 6. Multicellular glandular hair on the posterior margin of the palea. Fig. 7. Hairs on the margin of the palea. Fig. 8. Indusium. Fig. 9. Lateral view of the spore. Fig. 10. Sporangium.

(e, upper epidermis; l, lower epidermis; sc, sclerenchyma strands; iii, third row of stalk cells).

sely all over the outer surface and margin of the indusium. In addition, unicellular, papillate glandular hairs (with extracellular cap-like secretion at the apex) are also borne on the margin and surface of the indusium. Sporangium is of the common leptosporangiate type with a lense shaped capsule and a slender elongated stalk (Fig. 10). The sporangial stalk is slender, usually four cells long and two cells thick except at the capsule base where there is a short third row of stalk cells. The third row of stalk cell is usually 2 cells long and is in continuation to the stomium cells. The annulus consists of usually 13-15 indurated cells. The stomium is well developed and possesses prominent lip-cells. The sporangium is devoid of trichomes.

Spores are monoletate, bilateral, plano-to slightly concavo-convex in lateral view and oblong in polar view (Fig. 9). Perine deep

brown in colour, densely and minutely spinulose, partially adhering to exine. Perine folds are irregular, elongated and sometimes forming reticulations. The folds are up to 8μ high from the exine surface and papillate in optical section, with crenate crest. A pair of characteristic folds are usually present on either side of the laesura. Laesura tenuimarginate, *c.* 18μ long. Exine smooth, light brown and *c.* 3μ thick. Sexine is much thicker than nexine. On an average the spores measure $38 \times 50 \mu$ ($P \times E$, exclusive of perine).

ACKNOWLEDGEMENTS

We are indebted to Prof. R. E. Holttum and Dr Alen R. Smith for confirming the identity of the specimen and to Dr R. V. Sitholey, Director, National Botanic Gardens, for his keen interest in this work.

PRAKASH CHANDRA
SANTHA DEVI

NATIONAL BOTANIC GARDENS,
LUCKNOW 1,
March 2, 1972.